

## CLAIMS

What is claimed is:

1. A method of increasing utilization of user link bandwidth for a code division multiple access communications system comprising the steps of:
  - selecting a set of orthogonal complex codes each having a code length that is greater than a code length of an optimum real code and less than or equal to a spreading code length; and
  - transferring symbols across at least one of a plurality of user links to or from at least one of a corresponding plurality of user terminals wherein the symbols are represented by a corresponding one of the set of orthogonal complex codes.

2. The method of Claim 1 wherein the set of orthogonal complex codes is generated from a Kronecker tensor product given by formula:

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$$C_{L \times P} = A_L \otimes W_P$$

wherein

$C_{L \times P}$  is a matrix of orthogonal complex codes wherein each of the orthogonal complex codes has a code length equal to  $L \times P$ ,

$L$  is a positive integer,

$P$  equals  $2^n$  where  $n$  equals a positive integer,

$W_P$  is a Walsh code matrix for a code length of  $P$ ,

$A_L$  is a matrix of coefficients  $a_{jk}$  wherein  $j$  is a row index equal to 1 ...  $L$ ,  $k$  is a column index equal to 1...  
 $L$ , and

5         $a_{jk} = e^{j2\pi(j-1)(k-1)/L}.$

3. The system of Claim 1 wherein the corresponding one of the set of orthogonal complex codes has a code length of 12.

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4. The system of Claim 1 wherein the spreading code has a code length of 12.

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5. A code division multiple access communications system comprising:

a base station;  
a geo-stationary platform;  
a feeder link coupled to the base station and the geo-stationary platform for transferring symbols between the base station and the geo-stationary platform;  
a plurality of user terminals; and  
a plurality of user links coupled respectively to the plurality of user terminals and to the geo-stationary platform for transferring symbols between the geo-stationary platform and at least one of the plurality of user terminals wherein the symbols are represented by at a corresponding one of a set of orthogonal complex codes having a code length that is greater than a code length of an optimum real code and less than or equal to a spreading code length.

6. The system of Claim 5 wherein the set of orthogonal complex codes is generated from a Kronecker tensor product given by:

$$C_{L \times P} = A_L \otimes W_P$$

5 wherein

$C_{L \times P}$  is a matrix of orthogonal complex codes wherein the at least one of the orthogonal complex codes has a code length equal to  $L \times P$ ,

$L$  is a positive integer,

10  $P$  equals  $2^n$  and  $n$  equals a positive integer,

$W_P$  is a Walsh code matrix for a code length of  $P$ ,

$A_L$  is a matrix of coefficients  $a_{jk}$ , where  $j$  is a row index equal to  $1 \dots L$ ,  $k$  is a column index equal to  $1 \dots$

$L$ , and

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$$a_{jk} = e^{j2\pi(j-1)(k-1)/L}.$$

7. The system of Claim 5 wherein the at least one of the set of orthogonal complex codes has a code 20 length of 12.

8. The system of Claim 5 wherein the spreading code has a code length of 12.

25 9. A method of increasing utilization of user link bandwidth in a code division multiple access communications system comprising the steps of:

selecting a spreading code length; and

30 selecting a set of orthogonal complex codes each having a code length that is greater than a code length of

an optimum real code and less than or equal to the spreading code length.

10. The method of Claim 9 further comprising the  
5 step of transferring symbols across a user link to or from  
a user terminal wherein the symbols are represented by a  
corresponding one of the set of orthogonal complex codes.